Central Valley Salmonid Satellite Project Work Team -
Juvenile Monitoring Project Work Team

Meeting Notes
May 18, 2005
Department of Water Resources Building - Oroville Complex

Participants: Bill Poytress-(chair-FWS), Jim Earley (FWS), Richard Corwin (USBR), Ryon Kurth (DWR), Jason Kindopp (DWR), Matt Brown (FWS), Duane Massa (DFG), Jess Newton (FWS), Tom Cannon (Wildlands Inc.), Melissa Dragan (FWS), Jeff Kozlowski (Jones and Stokes), Andrew Hamilton (FWS), David Colby (FWS) and Matt McCormick (FWS).

I. **Modify/Adopt draft meeting notes from 2/15/05** – **B. Poytress** informed the group that no comments were received via email from the last meeting's notes which included recommendations and conclusions. **B. Poytress** then heard of no comments at the meeting, but said the review period would be another two weeks as he requested some overview by attending meeting members to verify the draft recommendations and conclusions prior to finalization of the meeting notes and subsequent submittal to the parent group.

II. **Modify/Adopt agenda** - The agenda was modified so Ryon Kurth presented the Feather River snorkel survey material instead of Jason Kindopp.

III. **Discussion topic: Underwater Observation Techniques and Juvenile Salmonid Habitat Use Assessment – projects, techniques, and results.**

a) **Ryon Kurth (DWR)-** *Distribution and Habitat Use of Juvenile Steelhead in the Lower Feather River.*

Ryon presented information covering snorkel surveys conducted on the Lower Feather River to describe characteristics of wild steelhead populations, in terms of distribution and habitat use with the further objective of developing PHABSIM. To accomplish this they looked at the river in 3 spatial scales (Broad/Intermediate/and fine). The broad scale surveys were completed annually between 1999 and 2001. Snorkel observations were made in the downstream direction by a team of 3 to 6 divers distributed among three transects. Data recorded included fish size and number, substrate type, cover and habitat type (run, glide, pool, or backwater). Intermediate surveys occurred monthly from March through August in 1999 – 2001. Nine permanent sampling sites were sampled including six in the Low Flow Channel and 3 in the High Flow Channel. These surveys quantified available habitat in terms of depth, velocity, substrate, cover and habitat types. Fine scale surveys were also completed monthly and 24 of 40 sampling locations were selected at random each month. Sites were 25m long and 4 m wide parallel to one river bank. Two divers snorkel upstream noting the number, species, size and position of all fish observed. Water depth, average velocity, substrate, cover and habitat type were systematically recorded at 36 points ($1m^2$ each) per site. **B. Poytress** asked how sample locations were selected. **R. Kurth** responded that sites were selected from the overall look at the glide-riffle-pool complex of the river and the sites were randomly chosen from the total number of sites.

The results from the investigations indicated that most steelhead (<100 mm) observations were made in the uppermost river mile portion below the hatchery (~70% in the 1st mile). Most juvenile steelhead were found within 4m of the bank. They noted a significant drop in number of fish observed after May and noted an increase in size class. To analyze the data they used a modified chi-square test to see if use of habitat was in proportion to availability (at intermediate snorkel sites). To investigate ontogenetic shifts in habitat use they used a one way ANOVA on average fork length across hydrogeomorphic and cover types. They also regressed fork length with depth and velocity. To assess factors influencing the occurrence of steelhead they employed a stepwise binary logistic regression analysis on the meso and microhabitat scale. Results of analysis indicated that velocity, depth and band distance were all positively correlated with fork length. The mean fork length of fish found in riffle habitats was significantly larger than glide, pool and backwater habitats indicating fish move to higher velocity water as growth occurs. The logistic regression results indicated that fish like overhead cover in a near shore environment. Conclusions noted that snorkel surveys provided valuable information on the distribution, abundance and habitat use of Feather River steelhead. More detailed information can be found by accessing the reports at the following link:
http://orovillerelicensing.water.ca.gov/pdf_docs/04-28-04_att_10_f10_3A_steelhead_hab_use.pdf

Comments/Questions:
D. Massa inquired as to why juveniles were not using the lower section of the River. **R. Kurth** replied that those areas are swifter areas/less suitable habitat. **D. Massa** asked if there were temperature issues and **R. Kurth** responded that larger fish are using those areas. **J. Earley** asked if juvenile observations are related to spawning times. **J. Kindopp** responded that spawning occurs Dec/Jan/Feb and fry appear mostly in April and May, most of the spawners being hatchery origin (adclips visible). **J. Newton** asked about the PHABSIM. **R. Kurth** replied that they worked with Thomas Payne and that information can be found in the report at the website listed above. **M. Brown** asked if the model jived with the observations. **J. Kindopp** responded partially and that the model says lower flows are more suitable, some parts were realistic and others were misleading. Substrate was an issue, there are not many larger rocks, cobbles considered cover. **J. Kozlowski** noted that for the Yuba River they studied habitat use via snorkel and e-fishing. He noted that some e-fished fish were very dark black indicating they were likely using substrate as cover. These fish were not seen in snorkel surveys much. **R. Kurth** said this is probably not much of an issue as the Feather has more hardpan [bed rock] surface. **A. Hamilton** noted that fish on the Trinity were noted as hiding under substrate at temperatures <45ºF. **J. Kozlowski** added that some fish as big as 60mm were found to be hiding in substrate. **J. Kindopp** noted that they e-fish in summer when fish are larger and that the data was similar to snorkel data. **J. Kozlowski** noted that temps rise on the Yuba farther downstream and more so in the near shore areas and that these areas are less suitable. **T. Cannon** noted that Yuba is different than the American because there is limited cover on the Yuba, in the American River fish are out in the open because there is more cover. **R. Kurth** stated that the *available* type of habitat is an important factor influencing habitat use. **T. Cannon** noted that cobbles are a good source

of cover to avoid such things as the sun. **J. Kindopp** noted that steelhead had been observed at times in as little as 5cm of water in open areas, not typical habitat. **T. Cannon** asked if they should increase flow in the low-flow section below the hathery? **R. Kurth** replied it would create some habitat but would require 3-5,000 cfs to create more rearing habitat by creating side channels. **J. Kindopp** noted that they find most of the trout closer to the dam and that these fish likely want to move up to cool high reaches, but can't. There usually isn't any shift in densities and few years show a bimodal pattern.

b) **Jess Newton (FWS)** – *Juvenile Habitat Use studies used to evaluate the success of Clear Creek restoration projects.*

Jess presented information regarding snorkel surveys they had performed in 2003 and 2005 to evaluate habitat use by juvenile Chinook in a 2 mile reach of the Clear Creek restoration project. The goal of the restoration project in this phase is to maintain or increase the quantity and quality of juvenile salmonid rearing habitat. The objectives were to design channel features to provide juvenile habitat to be retained for >5 years and to be utilized at levels 2 X the average densities of control reaches.

To monitor the results of Clear Creek's restoration Phase 3A, they performed snorkel surveys to evaluate habitat use by salmonids in the reconstructed channel as well as in control reaches (one above and one below the reconstructed area). Jess noted that the 2.0 mile segment was reconstructed by moving part of the stream channel, securing the bend with root wads and by putting in alcoves for juvenile habitat. The flood plain was also planted with riparian trees. Part of the old channel was left as a back water to allow for juvenile rearing as well. **J. Kindopp** asked how long are you going to monitor it to see if it works. Jess replied 10 years with observations taken every 2 years. The approximate price of the reconstruction itself was ~$600,000, for a ¼ mile section of stream. Jess went on to discuss the control reaches and treatment reach describing how a typical crew of 2 persons snorkeled downstream doing replicate shoreline counts. For backwater habitats total counts were performed. Their metric was fish/m^2 and densities were measured within 6 feet of shore. Snorkelers moved upstream when possible and surveyed from mid-February to mid-April.

Results from the 2003 survey indicated that the Phase 3A reconstructed area had the highest density of fish observed until the latter half of March when densities then began to decline. A flow event may have moved juveniles out resulting in lower observed densities in all reaches later in the season. E-fishing in the area noted a similar temporal distribution pattern. Observations recorded juveniles inhabiting root wads the most, followed by the flood plain vegetation and the back water area.

To analyze the data, Jess used a randomized block ANOVA due to the change in densities over time. In this way, variability could be isolated. Jess tested to see if the treatment area (reach 3A) was equal to the upper control and lower control reaches. At the 0.10 level of significance the Phase 3A was found to be significantly different than the control reach. Also the change in density over time was tested at the 0.05 level of significance and densities were found to be significantly different between week 1…week 7 (P=0.003).

For the recently acquired 2005 data, the results indicate elevated fish densities throughout the survey period in the control reaches and the Phase 3A treatment reach

when compared to the 2003 data. The cause of the elevated densities could be from observer bias, more production or better habitat. The treatment reach, similar to 2003 data, had the highest densities of all reaches surveyed and showed a similar trend in density across the survey period. Additionally, the snorkel crews began to survey control reaches and pre-Phase 3B to acquire baseline data prior to restoration of area 3B, an area of clay hardpan with no shore cover that is considered very poor salmonid habitat.

Preliminary analysis of the 2005 data (again using the randomized block ANOVA) indicated that the Phase 3A reach had densities significantly different than either of the two control reaches (P= 0.03; α=0.05). Further, testing of the Pre-phase 3B data to the control reaches indicated significant differences in fish densities (P= 0.01). **R. Kurth** asked if analysis using Tukey's pairwise comparisons test could be performed on the data. Jess indicated that would not work because the habitat lengths differ.

To conclude Jess noted that habitat quality in Phase 3A was at least equal to the control reaches in 2003 and better than controls in 2005. The habitat in 3A appears to be improving over time, and habitat in 3B is poor and restoration needs to proceed. Overall densities in the root wad areas were 3.73 x average, the old channel backwater was 2.38 X average, and the captured vegetation was 3.58 X average (average density = 2.90).

Comments/Questions:

J. Kindopp asked if observations are easier to make than before. Jess responded that observations seem to be similar in all areas except the "backbuster" reach (3B). **J. Kindopp** then asked if revegetation occurred above the root wads or along the shore. **M. Brown** responded yes but the clippings did not take hold or were swept away. **A. Hamilton** asked **J. Kindopp** how he though it was easier to see fish in LWD. **J. Kindopp** replied fish tend to school in these areas and can be easier to see. **T. Cannon** asked about steelhead and Jess replied that there were too few points to analyze. **D. Colby** asked why they had changed the alpha value for the analysis to 0.10. Jess responded that for biological systems it is sometimes more appropriate to use 0.10 for field settings, a 0.05 level of significance is better suited to a laboratory setting. **J. Kindopp** added that there may be statistical significance without biological significance and vice versa. **T. Cannon** asked if they were using averages in analysis. Jess replied that they aggregate for reach, which reduces variability and makes it easier to look at the data itself. **T. Cannon** noted that you may want to analyze the actual sampling units and not aggregate data – also consider adding variables like cover etc… and look at covariances and that the analysis results should be more powerful. **M. Brown** then asked if the 2005 data was as variable as 2003. Jess responded that they both looked highly variable. **J. Kindopp** asked if more habitats were added do you think you would get higher production. Jess responded they could not get the permits to place LWD or boulders in the channel. **J. Kozlowski** asked if the side channel received subterranean flow to keep temps cool and allow for refugia. Jess responded that the channel receives some tributary flow and later gets cutoff and can essentially become a wetland. **T. Cannon** asked if it would be too dangerous (with respect to future channel changes) to make it a side channel. Jess replied yes due to the hardpan below. **A. Hamilton** commented that he noticed a pattern of convergence near the end of March [on the graphs] in the two survey years and asked if Jess thought this was because most of the fish had moved out or are they more equally distributed. Maybe the structures can hold

higher densities or bigger fish are more mobile and can escape the observer. Jess replied that it is likely most of the fish moved out and there is more habitat for the remainders to disperse.

c) **Tom Cannon (Wildlands Inc./Fishery Foundation)** – *Snorkel Surveys and Fish Habitat Use in the Lower American River.*

Tom began by commenting that he has performed habitat use studies on the American, Stanislaus, and Consumnes rivers and that originally he thought snorkel surveys were not a viable means of collecting good quantitative data on fish habitat use. After working with folks from the Fishery Foundation, he has changed his mind and now considers snorkeling a good method to quantify habitat use by salmonids. Tom mentioned that the Foundation was hired to simply look into streams like the American and see what was going on in terms of habitat use. Tom decided to add some statistical rigor to the survey whereby he set up sampling units in defined river reaches – units were generally 6' by 50' areas (polygons) with the unit defined based on homogenous habitat. The total number of fish observed were recorded for each polygon (sampling unit) and there could be 5 to 20 polygons per river reach. Fish were recorded according to size class (25-mm intervals) and habitat was classified by cover type, bank slope, water temperature, velocity, depth and substrate. Reaches were chosen every mile and the crews used aerial photos to define sampling unit boundaries. **R. Kurth** asked how easy was it to snorkel directly in the polygons that were plotted on the aerial photos. Tom replied that the crews had no problems and used the shoreline patterns and trees as reference points.

Tom noted that in some areas milfoil (an exotic aquatic plant) was found to be a form of cover that fish used and at times there could be a 5º C difference in water temp between the channel and shoreline sides of milfoil beds.

To quantify habitat use Tom's group looked at density of fish/ft^2 as the dependent variables and habitat measurements as independent variables at each polygon. Slope was found to be related to cover. The data can be used to show if constructed habitat is used and to compare it to natural habitat. He noted cover has a significant effect on habitat use and that as temperatures rise densities drop (temperature has a comcominate effect). He noted that it is important to consider multiple variables and their combined effects.

Tom then covered sources of sampling error associated with this methodology and noted ID of fish can be a factor (CHN vs. STT), the shear numbers of fish present that are crudely estimated visually (although counts are estimates they will be log transformed), and that velocity and density can be highly variable noting less density at higher velocity. He added that slope is related to velocity but the relationship varies with stream flow.

Tom then spoke about analysis of collected data and noted some trends in fish density in terms of velocity, slope and cover. He then looked at the data performing a multivariate analysis and noted that trout and Chinook were strongly associated with cover and bank slope. He then commented that it is good to plot the data in graphic format to see underlying relationships. Tom concluded by saying that the American River (and other CV streams) needs more cover. These are just surveys not experiments with controlled variables and that you need to develop hypotheses that can be tested with

a controlled experiment. He added, that we should not forget about the amount of habitat available when determining habitat use and try and control sources of sampling and experimental error. We should also watch out for biases and have fun collecting, analyzing, and interpreting the data.

Comments/Question:

A. Hamilton asked if Tom's group had looked at temperature vs. bank slope. Tom replied that they had found slope to be related to temperature and concluded that fish prefer shallow, lower velocity, cool (shaded) water. He noted many areas were not used by juveniles because they needed more cover. **J. Newton** asked if water could be used to control temperature and Tom replied NO and Andy noted the water use is maxed out. A question was asked about pre-spawn mortality and its correlation to temperature or habitat. Tom replied there are 85,000 salmon spawning in just 8 riffles and a lot of fry are produced under these extreme conditions. **D. Colby** asked if Tom had seen many yolk-sac fry to which Tom replied that most observations were of buttoned up fry. **M. Brown** asked what conclusions Tom had about the American River and Tom commented that more side channels could greatly increase production of steelhead. Tom also noted that having controls, like in Clear Creek, can give others good information about what is needed for natural systems. Otherwise it is hard to separate variables. **M. Dragan** asked if recreation is beneficial or negative to which Tom thought it provided more cover (~10% of river surface area covered by rafts on the American at times) and that the fish are used to it.

Lunch 12:40 to 1:10

d) **Matt Brown (FWS)** – *Juvenile Chinook Habitat Use Studies on Clear Creek – Evaluating Stream Channel Restoration Projects.*

Matt presented information about the proposed 5 year study to determine juvenile habitat suitability indexes (JHSI) based on fall Chinook. The JHSI will be used as part of the Clear Creek Instream Flow Incremental Methodology (IFIM) project that has been mandated by the CVPIA. The IFIM study will be conducted by the Sacramento Field Office with assistance by the Red Bluff Office to do adult HSI and juvenile rearing HSI. Matt's presentation focus was to talk about JHSI, in terms of what it is used for, how it is performed, to get feedback from the group, and to improve IFIM using fall Chinook spawning as an example. Another part of the study will be to use PHABSIM to get the overall amount of habitat at various flows. The study group wants to find out if different models are needed for different creeks and if there should be run specific HSI's (determine if different runs use habitats differently).

To date, looking at the Phase 3A restoration area (previously discussed by Jess Newton), Matt's group had hoped that the Weighted Useable Area (WUA) curves would be much higher after the restoration. The curve seems to be stabilizing (2004 data) after an initial increase over pre-restoration baseline data (2002). The objective being to have flows at the best case scenario. So far, depth and use by Chinook does not correspond well to HSI values. Water column velocity and use appear to be close to HSI values.

Matt's group plans to perform a total of 6 JHSI's for fry and juvenile fish (spring/fall Chinook and steelhead/rainbow trout).

Matt's group plotted actual redd distribution over Mark Gard's predicted redd distribution to test the observed versus predicted distribution. The results were: 2002 redd locations were not very similar, 2003 and 2004 the predicted hot spots were not actually used. Matt believes the model lacks something important as fish are not spawning in the predicted areas in Clear Creek. Additionally, the model predicts that fry and juveniles use similar depth and space in the water column, but observations do not confirm this. Matt noted there are differences in the way data is collected between the Sac office and Red Bluff. Sacramento is snorkeling upstream on the Yuba covering a small area and they are measuring unoccupied areas more systematically. On Clear Creek they snorkel downstream and cover most of the creek measuring unoccupied areas only when they measure occupied areas of the same reach. They measure water depth, velocity, adjacent velocity, substrate and cover. **A. Hamilton** asked what numbers of fish are you seeing. **J. Newton** replied with 10 fish that are probably spring Chinook, to which Andy asked how do you know. Jess replied because of a barrier weir installed to separate the fish. Andy later asked why SCS would be different than FCS and Matt responded that the upper reaches of the creek are steeper slope canyon, with more gradient and lower water temperatures. The fish may have a different habitat available to use. Following a side discussion on fall versus spring Chinook **R. Kurth** noted that the model does not take into account factors such as predation and feeding habits which may have an effect on distribution. **A. Hamilton** noted that the lines seem to match, but maybe you can take the criteria measurements on Clear Creek and use Sacramento parameters. **J. Newton** commented that maybe Mark could adjust flow, water depth and substrate. **J. Kindopp** noted that maybe the model does not apply to juveniles. **T. Cannon** noted that Tim Horner at Sacramento State University has been adding new variables to Mark's model. Matt then asked the group what can they could do to make a more accurate curve, what things need to be added as this is a $1.2 M project? **J. Newton** added that Thomas Payne has written a paper on the output for using spawning(?). Matt asked Jason if they had applied their redds to the model and Jason replied they were close, but they hadn't overlayed the redds. **J. Newton** noted that they redo their maps every year, but cover and substrate change every year and are not updated. **J. Kozlowski** asked if they calculated average velocities to which Jess responded Yes.

Matt then noted that differences were also observed in the Merced River and that it is good to get out in the field and look to see exactly where fish spawn. **R. Kurth** noted that small sample size can be a real problem and Jason noted that maybe you could transplant marked fall juveniles and study them. Matt replied that probably wouldn't work because the falls tend to move right out of the area. **A. Hamilton** noted that adjacent velocity may be important but may not be well represented in the model. You need to get out there and collect the data and maybe you could increase flows and take measurements. **T. Cannon** noted that juveniles will go any distance to eat. **J. Kindopp** noted that juvenile steelhead stay in still water but may feed at the edge or anywhere else. Matt then noted that they may be able to experiment with cover types and attempt to verify the relationship at a range of flows. **J. Kozlowski** added that snorkeling can work

better than e-fishing for habitat use due to the bias' of e-fishing and the disturbance factor.

VI. Tentative Agenda Items for the proposed August 24th meeting:

The proposed next meeting of the Juvenile Monitoring Project Work Team is Wednesday August 24th, the topic being mark-recapture studies with an emphasis on marking techniques and basin-wide coordination of marks. Other ideas mentioned including redd capping, wild-stock tagging and pit tagging studies of juvenile fishes.